

WARING (G.E.)

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THE
Sewerage of Columbus, Ohio.

ADDRESS

OF

COL. GEORGE E. WARING, JR.,

AT

BOARD OF TRADE AUDITORIUM, COLUMBUS, O.,
MONDAY EVENING, JUNE 23, 1890,

AND

DISCUSSION FOLLOWING.



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THE WESTBOTE CO., BOOK AND JOB PRINTERS.
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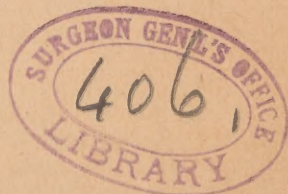
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MONDAY EVENING, *June 23, 1890.*

Hon. James M. Loren, President of the Board of Public Works, in introducing Col. George E. Waring, Jr., to the audience, said:

GENTLEMEN: Sometime since a petition was received by the Board of Public Works, stating that the petitioners were of the opinion that the intercepting sewer, as contracted for, was too small and was inadequate for present use, and decidedly so for future use. That claim has been made by a great many citizens, and, I think, every one who has undertaken to procure right of way for that sewer has experienced great difficulty on account of the dissatisfaction on the part of property owners as to the size of the sewer. And, in considering the matter, it was thought advisable by nearly every body who discussed the subject at all, to have this question settled by procuring a written report from some one who was recognized as authority upon the subject of sewerage. After discussing the matter with those who we knew had a particular interest in the question, it was decided to procure such an opinion. Thereupon, the services of a gentleman, who, I believe, is acknowledged to be the best authority, probably in the United States, or at least as good as we have, were sought and obtained. Upon his arrival in the city, and after consultation with him, it was concluded the best way to satisfy the citizens, directly interested in the matter, would be to have a public talk upon the subject of sewerage of the city, and that is the object of the meeting to-night.

It is suggested by the gentleman that after his address and consideration of the subject, any member of the audience may feel perfectly free to ask such questions as he may desire, and in this way promote discussion which will secure us the greatest information upon these questions.

I now have the pleasure of introducing to you, Col. George E. Waring, Jr., of Newport, R. I. [Applause.]

Col. Waring then spoke as follows:

In the correspondence I had with the Board of Public Works, the statement was made that an intercepting sewer had been provided for before the Board was organized, and that I was requested to come to Columbus to investigate the conditions that that sewer was intended to meet and to give an opinion as to its efficiency. It was finally requested that

I should add to that service an examination, and report on the general sewerage system of the interior of the city. I made a visit here week before last, went over the subject rather carefully, and propose now to state the conclusions at which I have arrived.

I shall assume that the only branch of the subject in which you are especially interested, in fact the only practical question before us, is the question of removing and dealing with the foul sewage of the city. You are so fortunately situated, on the banks of a copious stream that so far as the principal part of the city is concerned, there is no difficulty in getting rid of the storm water falling on the surface and discharged through the existing sewers of the town. It is evidently the purpose of the intercepting sewer, to remove a certain portion of this storm water for a considerable time, but it seems to me that it practically makes no difference whether the surface wash of the streets flows directly through the branch sewers into the river as now, or whether a portion is carried on to a point below the city; for the reason that when the surface flow amounts to any thing very serious, the river itself will be so much increased in flow that no inconvenience will result from it. You will, therefore, please remember that in all I say to-night, I refer only to the foul sewage of the city, or to what is called "the dry weather flow;" that is, to the waste waters from houses, manufacturing establishments, etc., which are fouled with organic matter that requires removal, and, in your case, requires subsequent treatment in order to prevent its becoming ultimately a nuisance.

If I were to suggest an ideal system of sewerage for Columbus, it would be that there should run, substantially on the course now laid out, from the north end of the city to the south, an intercepting sewer, of sufficient capacity to receive all of the wastes of all the houses and manufacturing establishments in the city, delivering them to a point well below the present limit of population, and so arranged that as the population extends southward, the facilities for getting rid of organic wastes can be carried on still farther, under conditions suitable for the purification of the outflow; that into the intercepting sewer there should be discharged local sewers receiving and conveying all of the wastes of the houses; that connecting with these interior sewers there should be drains leading to the houses, serving as outlets for well regulated, well constructed and properly cared for house drains; that the whole system should be suitably ventilated, suitably cared for, suitably constructed and managed under the direction of the Board of Health, or Board of Public Works, or whatever branch of your government may be charged therewith.

The beginning of the sewerage system is in the house. It is there that the foul matters that are to be treated are produced, or rather that they are first delivered after use.

It, therefore, seems to me that the most important question that any town has to consider, is not the character of its street sewers, nor the character of its intercepting sewer, nor the condition of the stream into which this sewage is discharged, but the condition of the drainage of the house in which the family lives.

We hear a great deal in these days about sewer gas and its poisonous effects. I have maintained for a long time, and I think with perfect reason, that at least ninety-five hundredths of all sewer gas, from which our people suffer, is home-made; that there is more foul odor produced, more of the germs of disease fostered, between the public sewer and the water closet, kitchen sink, bath, etc., than beyond in the public sewer. I think, therefore, that while the movement that has now been undertaken is an

extremely important one; while it is difficult to get the attention of the public concentrated on the question, except by offering it, as we might say, butt-end foremost—the large proposition first—I still think that the most important consideration as affecting the people of Columbus, or of any other town, is, as I said before, not the condition of the sewers in the streets, not the condition of the intercepting sewer, but the condition of the drains and plumbing appliances of the houses themselves.

On the question of house drainage, which in these last five to ten years has attracted a great deal of attention, I asked what regulations had been adopted by the city government in that regard, and was informed to-day that there were no ordinances and no regulations affecting any thing, excepting the manner of constructing privy vaults and cess pools and caring for them. That is to say, there are no regulations concerning the manner in which the poor and ignorant, or the rich and ignorant, man shall introduce the plumbing appliances into his house, nor as to the manner in which he shall be obliged, in his own interests as well as the interests of his neighbors, to discharge his wastes into the public sewer.

I attempted to make an investigation of your public sewers, of your local sewers, the sewers in your streets, and I found that it was necessary for me to supplement the little that I was able to obtain in the way of information with my knowledge of the way in which such things are done in almost every town like this in the country—like this and smaller.

The sewer in the street ought to be absolutely tight as to its joints, and as to its material, so that no foul sewage can escape to contaminate the ground. It ought to be laid on such sufficient, regular and uniform fall as to insure the complete removal of every thing it receives, without halting, with a cleansing velocity at every point. It ought to be so smooth as not to arrest fibrous or solid matters and retain them until they putrify in the sewer. It ought to be flushed, either artificially or naturally, so that whatever may inevitably be deposited from the houses shall, before putrefaction commences, be washed completely and fully through to the outlet of the sewerage system. It ought to be so ventilated that the slight sliming of the walls, which will be occasioned in spite of the most perfect system of flushing, may decompose in the presence of such a volume, and such a change of air, that the products of decomposition shall escape freely without injury to those living within reach of the outlet of the ventilation, and so that no such condition, as that which we understand generates sewer gas, can possibly exist.

These sewers ought to be so connected with house drains and with the intercepting sewer, that every particle of organic waste matter entering them shall be delivered at the outlet of the sewer and disposed in whatever form may have been adjudged necessary and desirable, before putrefaction has set in. There is no harm to be apprehended, no danger to be apprehended, from any of these waste matters until their putrefaction has begun. If the putrefaction takes place in the house drain, in the local sewer, or in the intercepting sewer, then things are not as they should be. If every thing is swept forward except the slight sliming of the walls to which I have referred, and delivered at the outlet before the inevitable putrefaction comes on, your condition is what may be considered ideally perfect.

To accomplish this result is the object of every good system of sewers.

Now, that we may understand the reason for this complete removal and proper disposal, let us consider the conditions of a single family, living on a porous soil in the country, and getting rid of its waste matter,

its kitchen waters and chamber lye, by throwing it at different points over the ground, not throwing it twice in succession on the same place, and resorting for the purposes of defecation to the bush, having no deposits and no accumulations anywhere. Under these circumstances, all of the organic wastes of the house and of the family will be entirely destroyed by what we may regard as natural processes, in such a way as to admit of no possible injurious effect. Let that same family get the false idea into their heads that they are doing a more decent thing by building a privy and slop sink over a tightly cemented vault, that is ventilated only by a single pipe, extending through the roof of the building covering the vault; these elements of waste matter, which under the other condition were perfectly disposed of by oxidation, by the action of birds, of worms, of insects, and of the wind, are now all concentrated in a tight bottle, to which moving air has no access, and where an injurious and, under certain circumstances, fatal decomposition takes place, where offensive gases are formed, where, if the germs of disease exist, they are encouraged and multiplied, and where the family, instead of being subjected to natural influences, instead of living under natural conditions, is subjected to really unnatural and extremely dangerous conditions.

Now, a community, of whatever size, is simply an aggregation of families. If a town like Columbus, for instance, deposits its kitchen wastes, which are far more serious than water-closet wastes, and its water-closet wastes also, into holes in the ground, where they are withdrawn from perfect ventilation, where their decomposition is incomplete, or if these matters are deposited in faulty sewers, where they lie and decompose instead of being carried directly to the outlet, there arise conditions which are extremely unfavorable to public health.

Therefore, to repeat, what I consider an ideal system of sewerage, is one where small but good house drains deliver all of the waste products of the house into the sewer, where the sewer is absolutely tight, where the sewer is smooth, where the sewer is well flushed and well ventilated, and carries its product rapidly forward to the intercepting sewer; where the intercepting sewer has sufficient velocity of fall to deliver them at the outlet before putrefaction begins, and that then they are delivered into a sufficient stream of water, or by treatment in some other manner, they are rendered permanently innoxious.

It is now in order to report on the conditions that I came here to examine, and which I found by observation, by an examination of the records, and by an inquiry into the methods in vogue. I find that your intercepting sewer, as planned, is 45,838 feet, or about $8\frac{2}{3}$ miles long. At its upper end, 4,983 feet is described as 24 inches in diameter; following that, 8,685 feet is 30 inches in diameter; following that, 6,023 feet is 36 inches in diameter. The size then increases gradually to four, five, six and six and one-half feet in diameter. The first 20,000 feet, or nearly one-half of the length from the upper end, has a fall of 1 to 1,000, or about five feet to the mile; the next 15,000 feet has a fall of 1 to 2,000, the last 11,000 feet a fall of 1 to 2,500. I am, of course, using only round numbers. The capacity of this sewer, at its different sizes, I have calculated on this basis: that the sewer may be allowed, without injury, to run two-thirds full at the time of greatest flow; that each member of the population will be supplied with 60 gallons of water, and will consequently produce in one way and another 60 gallons of sewerage, which is a very large allowance; that one-half of this 60 gallons will be discharged, not in twelve hours, but in eight hours, the use of water being much greater during the forenoon than during the rest of the day. Then, in round numbers, I

find that, so far as the foul sewage is concerned, the 24-inch sewer, on the grade at which it is proposed to lay it, will accommodate 33,000 population; the 30-inch sewer that follows, will serve a population of 94,000—not very far from the present population of the whole city; the 36-inch sewer, on the grade at which it is proposed to be laid, will serve 149,000 population. This, you will please understand, makes no allowance for the admission of ground water into the sewers. I have no data on which to base a calculation of that sort; but you will see, I think, that as a 30-inch sewer would amply accommodate the present population of Columbus, it would be quite large enough at the point where it is proposed to use it, for the population it is to serve, and for any soil water that can filter into the sewers. At the lower end of the sewer, where it is six feet in diameter, and where the inclination is much less, the capacity is sufficient on the above basis for 575,000 persons. Within these limits of population, therefore, I think that you may rest assured that your intercepting sewer is large enough, and if it is reasonably well constructed you will have no difficulty from its want of capacity to remove the wastes. [Applause.]

Coming to the question of the general interior sewerage, as I have already stated, I was unable to find that any great attention, beyond the intelligence of the individual householder, and the intelligence and fidelity of the plumber, have been devoted to the question of house drainage. Concerning the sewers in the streets, I have been able to make no personal examination. I have been informed by the city engineer that the methods adopted here are not very different from those in vogue in towns generally, where they are governed by one or the other of the political parties; where the city engineer is supposed to be a faithful Democrat, or a faithful Republican, and where the inspector, upon whose fidelity, intelligence and integrity the whole success of the work depends, is appointed, not because he is qualified to be a good inspector, but because he is a good worker in politics. The result is, that you have no good sewers in Columbus to-day. I make that statement subject to correction, provided the correction can be backed by proof, which I believe it can not be. I am told that it is not unusual for the grade at which a sewer is to begin to be given to the contractor, or the inspector; that he digs down to that depth and digs to full grade only deep enough to put in one pipe; that it is put in, and he then digs back far enough to put in another, and makes the connection; that under no circumstances does he do what is imperatively necessary, I think, viz.: to open the trench for a considerable length, bring it to a proper grade, place the pipes in carefully with proper bearing, introduce gaskets in such a manner that they themselves shall not be driven into the sewer, but that they will serve to prevent the intrusion of cement into the sewer, and then cement the joints in such a way that they will be absolutely tight. This is not done. The work, I am sure, is done here just as it is, under similar methods of administration, in almost every town in the United States. Your condition, though bad, is not exceptional; probably not worse than in hundreds of other places of the same character.

I will, therefore, venture to say, for the purpose of emphasizing my opinion, that there is in Columbus not one local sewer that is tight as to its material, or as to its joints. If it is of vitrified pipe, it is probably in many places cracked, or broken loose from its socket; frequently the spigot of the pipe is not introduced into the socket, but is only brought against it, and not always even against it. I will venture to say that there is sometimes a space of half an inch to an inch between the end of the

socket and the end of the pipe, and if an examination could be made of all the joints of all the sewers of the city, it would be found that not more than one-half of them were reasonably tight as to cementing. I believe that you have not one sewer that has such a regular, uniform and sufficient fall; that there is no point in it where deposits are not caused by lack of velocity of the stream flowing through it. Those deposits may be flushed out during rain storms when there is a strong current, but the deposits are sure to be repeated after the storm is over, with the flow of other matters from the house drains. By the same token, I think you have not one sewer that is so smooth that it will not, at some points, catch fibrous matters, or retain solids, and cause deposits, which, by their putrefaction, produce what is popularly known as "sewer-gas," and cause some of the evils that sewer-gas is supposed to be responsible for. It is understood, of course, that no effort has been made to flush your sewers by other means than the introduction of water through street inlets, or through man-holes, or during storms, and that, therefore, during the long droughts of warm weather, when the decomposition of deposits is excessive and when the odors of the sewer are the greatest, there is no reliable daily application of any means for cleansing the sewer thoroughly. They are what have so long been called, elongated cess pools, containing an extremely injurious and unpleasant atmosphere.

Concerning the ventilation of sewers, I have been able to get no information. On general principles, I would also carry the criticism to the point of saying that there is probably very little good house drainage in Columbus. You have probably 15,000 houses. A certain small number of those have had their drainage carefully guarded by architects, or by plumbers, who were directed to do the best that could be done, but as a rule, in the majority of houses, and particularly in the tenement houses, which are hired from landlords whose chief object is, naturally, to get an income, the condition of the plumbing is, without doubt, such as to make it desirable that very decided and radical changes and improvements should be made. The general result of these defects is that you have not yet approached the condition of complete immediate removal; that a very large part of the waste matter that is discharged into your sewers lies there until it rots; that the outflow of your sewers, instead of being simply dirty water, contains floating particles of organic matter—a nasty, inky-colored, vile-smelling, putrid mixture of liquid and solid substances.

Now, I have stated the defects that exist here, as they exist almost every-where, in these strong terms, not because of any desire to criticise the condition of things existing in Columbus, but simply because it seems worth while that those who have taken sufficient interest in the subject, and have come here to hear what is to be said about it, may understand that something more must be done than you have thus far attempted to do, as a community, before you can hope to have your city in a perfectly good sanitary condition. But I want here to repeat the statement that in my judgment it is far more important for the health of the city that these details of house drainage and street sewerage should be attended to, than that you should have a good intercepting sewer to take up your foul liquids and carry them out of the way, where they will cause no offense.

We now come to the practical question as to what recommendations should be made in view of the state of things as we find them. I believe that your intercepting sewer should be finished according to the plans and contract, with some slight modifications. For example, Mr. Kinnear finds that at the upper end, by reducing the grade slightly for a certain distance, he can save a considerable cost of construction. There is no rea-

son why that should not be done. There are points, as there always are in letting a long line of work, such as this, where a little change here and there will save cost, or increase efficiency. But on the whole, and as a general question, I think that your intercepting sewer plans ought to receive the approval of any engineer who may come here to investigate them, and to consider the work that it is proposed that that it shall do.

The specifications call for the building of the upper end of the sewer, where it is 24 inches in diameter, with 24-inch pipe. I have myself recommended frequently, in years past, the use of vitrified pipe of as large a diameter as 24 inches. I shall never do it again. Those pipes are not reliable, and I do not know to-day of a 24-inch sewer, nor a 20-inch sewer, nor an 18 inch sewer constructed in that way that I should consider reliable. The material is not a safe one to use in these large diameters, and I shall hereafter use nothing larger than 15 inches. Every thing beyond that I shall make either of concrete or of brick work. I therefore recommend that the upper end of this work, although only 24 inches in diameter, be constructed of brick, rather than pipe. Very likely it will be necessary to modify somewhat the size of the upper end of the sewer, according to the population that it is intended to serve, and according to the figures I have already given. If it is found that the 24-inch pipe comes farther down than a point at which it may be expected to receive the sewage of 33,000 people, then it ought to be increased in size. The lower part of the sewer is large enough.

I notice also that it is provided in the specifications and in the contract that, where the sewer is three feet in diameter, it shall be built, as we say, of two rings; that is, that it shall be eight inches, and a streak of mortar thick, instead of four inches. It seems to me that this is a waste of material, and will fail to secure the best results. There is no reason why a 36-inch sewer may not be made of a single ring of brick. Any engineer, contractor or inspector attempting to build a sewer of a single ring, will be very sure to have a good quality of brick, good cement, and good workmanship; whereas, if he is allowed to use two rings, he may put in any thing he likes, expecting that the mere bulk of material will carry him through.

I have had a good deal of experience with sewers of that size, with both eight-inch walls and four inch walls, and in my opinion the four-inch walls are stronger, the joints tighter, the material harder, and the friction of the stream has a great deal less effect in washing out the mortar and leaving it rough because the mortar is better. I therefore recommend that so far as the sewer is three feet in diameter, it be reduced from the double ring to the single ring.

The sewer is now finished to a point 10,735 feet this side of the proposed outlet, and at a point on the river side of the canal. I recommend that it be stopped there; that nothing further be done beyond that point. There is something more than two miles from that point to the outlet, over which a sewer of six feet and a half in diameter, costing \$6.93 a foot, or a total of \$74,393.55, is recommended to be built—for some reason that I am unable to comprehend. There is no condition of the water at the lower end, two miles below this point, that is in any important respect different from the condition at that point.

The statement is made in the report of the consulting engineer that the river will take care of the sewage for five years to come if it is delivered down there. In my opinion, in dry hot weather, after the intercepting sewer is finished and connected with the lateral sewers, it will not take care of the sewage five weeks without causing a crying nuisance. The

volume of water and its velocity are much too little to receive the sewage of a town like this. The plan as presented contemplates the purification of the sewage by application to land, and builds this extra two miles, as I understand it, only as a temporary expedient. I see no reason why the outlet can not be made from the point to which the sewer is now finished directly into the river. It can cause, so far as I am able to judge, no greater nuisance there than it will below: and not a very serious nuisance if the works are prosecuted rapidly, and there seems no justifying reason for expending nearly 75,000 dollars for such a mere temporary benefit; the more especially as the land to be used for purification is highest at this end: and as the scheme seems to be, as I understand it, to carry the sewage two miles beyond the point at which you ought to begin to deliver it on to the land, and then either there, or at a point higher up, to pump it over on to the land for disposal.

I therefore recommend emphatically that the main sewer be cut short at the point to which it is now finished, on the other side of the canal, below Moler street, saving 10,735 feet.

Before taking up the subject of disposal, it will be well, perhaps, to consider what it is practicable and proper to do with the local sewerage of the town. Now, of course, it is not to be supposed that a city like this, which has built sewers in nearly all of its streets, and assessed their cost on the property owners, and has lived happily in its house connection with those sewers, is going to accept patiently, or ought to accept patiently, the suggestion that they abandon those sewers in order that something else may be tried. I think that you will inevitably in time, but gradually, and in such a way as not to feel the cost of it, relegate all your present system of sewers to the removal of surface water, to the removal of storm water, and let that flow directly into the river; that you will, little by little, introduce into your streets, a system of perfectly tight, perfectly smooth, perfectly graded, perfectly flushed, and perfectly ventilated sewers to carry the sewage of your houses into the intercepting sewer. And, that in the course of time, all of this portion of the city will be sewered in that way by a double system, much of which will be necessary in any case, because of the conformation of the streets; and that in your new work, in the northern part of the city, on the west side, in the east end, and wherever you are extending sewers, two objects will be borne in mind: One, that where storm water is liable to accumulate in such manner as to do harm and injury to public or private property, it shall be led to an independent sewer devoted to that purpose only, and conveyed by that sewer directly to the river; and that wherever houses are built and drainage is required, house drains shall be properly connected with separate sewers, leading directly into the intercepting sewer. Now, this is far more important in your case than in the case of most towns, because you are confronted, with your present population, with the rather serious question of the final disposal of your sewage wastes. Every thing that you deliver must, sooner or later, in my judgment, be purified in a manner that I shall presently describe, on land; and that application will involve a certain amount, not a very serious amount, but a certain amount of pumping. The cost of that pumping ought not to be increased by the requirement to pump rain water, which can do no harm by being conveyed directly into the river.

I, therefore, think that the ultimate result will be that the old parts of the town will have separate sewers, leaving the present sewers for storm water, and that the new parts will have a universal system of sepa-

rate sewers, and will have local storm sewers wherever the conformation of the land indicates that they are necessary.

Now, with regard to the great problem of disposal. I see that your consulting engineer has followed the course of a very large proportion of modern writers on the subject, and has attached his faith to what is a most admirable system that is called "Intermittent Downward Filtration."

This is simply the pouring of a very large volume of sewage on to porous land, allowing the water to escape below, the land retaining the impurities, and the water either pumped out or drained out in some other way. The system is as good as it is said to be; but it may, after all, safely be called the "sanitary fad" of the day. It is expensive. It does its work well if it is very carefully attended to. It purifies the sewage, but does not give any material return in the form of crops. It simply takes dirty water and purifies it in an expensive way. It is a thing that any town ought to use that is so situated that it can not do anything else; but I can not for the life of me see any reason for recommending it for a place like this. You have on the west side of the river, below Greenlawn avenue, not less than six or seven hundred acres of farming land that can have no very great value, that is as well situated and as well constituted for the purification of sewage as any I have ever seen in my life; and my recommendation would be that the city buy, beginning at a certain hedge a short distance below Greenlawn avenue, and extending as far down as it may be necessary to go, at least six or seven hundred acres of land; that it make an overflow from the present termination of the intercepting sewer just on the other side of the canal, by an open channel, directly into the river; that on the east side of the canal, properly protected against floods, it construct a sump and pumping apparatus, with an outlet across the river, to deliver on to this land; that that land be put into perfect condition (and it will cost very little to do it). I should say fifty dollars an acre would prepare it all for the reception of the foul sewage of the city, so far as you may find it desirable to deliver this on it.

With regard to the sewage of the West Side, it is a question that can not be determined, I think, without more levels than have yet been taken, whether it would be better to lay a sewer down to the land on that side of the river, or to carry the sewage to a sump and pump it down there, or to carry it to a sump and pump it over into the intercepting sewer. That is a matter that requires study, and I have not had before me the data to enable me to determine the question. But you have within easy reach, perfectly well situated, the ability to dispose completely of the sewage of a city of a half million people, and you are entirely free from the serious drawbacks which sometimes attend agricultural irrigation.

The most serious question is, that in spite of all you can do, you will have more sewage during rainy weather than during dry weather, though you attempt to take only the dry weather flow. In your case, the wet weather flow would be very much greater through the intercepting sewer and at the pumps. It is very objectionable to have to deliver an excessive amount of sewage on to land that is already overcharged with its own rain-water; and farmers make more complaint of that than of any thing else. But you are so situated that whenever those heavy rains come, or even light rains, you can deliver all of your sewage into the river, if you like, until the ground is ready to receive it. I believe that you can at any time, even when you have two or three times your present population, deliver all your sewage into the river for two or three days without injury or harm. If you then stop for a week, or ten days, the river will purify itself and no nuisance will be created. I think that the sewage may

be used for the growing of grass and clover, or whatever it may be desired for, and if for four or five days during harvest it is desired to have no sewage on the land, the whole flow may be delivered into the river without objection.

In short, on general principles, it seems to me that in the details of the work you are almost better situated than any town I have ever investigated for a satisfactory, economical and effective system of purification by agricultural irrigation. I believe that the rental value of the lands will be enormously increased, as it has been in the neighborhood of large cities in England and on the continent of Europe, wherever sewage has been abundantly supplied, with the condition that it need not be forced on to the land during rainy weather.

I believe that is all I have in mind to say in my main remarks. I shall be very glad to hear an expression of opinion, and to answer any questions that any member of the audience may choose to ask. [Applause.]

DISCUSSION.

The following discussion then took place:

Mr. D. N. Kelley: Colonel, I would like to ask you what material you recommend for house drainage?

Col. Waring: For what purpose do you mean?

Mr. Kelley: I mean going into the street from the house, and especially that portion that is under the house or in the basement.

Col. Waring: I should certainly use iron pipes every-where in the house and at least four or five feet outside. Beyond that I see no reason why good vitrified pipe or good cement pipe can not be used.

Mr. Kelley: What sized pipe would you recommend from the house to the street sewer for a 10- or 12-roomed house?

Col. Waring: I have drawn up the plumbing ordinances for a number of different towns, and I have always limited the size of their pipes absolutely to four inches.

Mr. Kelley: I will state here that nine-tenths of the house drains in the city are 9-inch pipe from the house to the sewer.

Col. Waring: Have you ever examined to see what condition it was in; how much was open and how much of it was full?

Mr. Kelley: No, sir; we never had any authority to do that.

Col. Waring: Of course where you take a great amount of roof and yard water you may need more; but if it is only a question of removing the roof water of an ordinary dwelling house and all the water it is possible to deliver through a dozen bath tubs and water closets, you can not begin to fill a four-inch pipe.

Mr. Kelley: Would you recommend the overflow from the cistern to connect with the house drainage?

Col. Waring: By no means. Do you mean cistern or cess pool?

Mr. Kelley: From the cistern.

Col. Waring: I should consider that absolutely injurious, poisonous. The cistern, I presume, is a rain water cistern, used for house purposes?

Mr. Kelley: A rain water cistern, and the rain water is used through the house in the lavatories and bath rooms, and washing clothes and all domestic purposes.

Col. Waring: Not used for drinking?

Mr. Kelley: Not used for drinking; hard water being used for that.

Col. Waring: That I think would be the danger, that it would be the

easiest water to get at, and it would be used for drinking. There have been a good many cases recorded of the propagation of typhoid fever by precisely that process.

Mr. Kelley: The waters from the roofs are discharged into the cistern and the surplus flows off into the sewers. What recommendation would you make with regard to the ventilation of house drainage?

Col. Waring: I am rather radical on that subject. I should ventilate the house drains from the sewer, through to the top of the roof. I should never put or allow to be put, a trap on the main drain. I should have the sewer in reasonably decent condition, and then I should depend upon this universal ventilation all over the town, through the four inch pipes, leading above the roofs of the houses, to produce such a change of air as to keep it in better condition than it can be possibly kept in any other way.

Mr. Kelley: Then do you consider one line of soil pipe for the house is sufficient ventilation?

Col. Waring: Perfectly: not one house on a long sewer, but a four-inch pipe for every house along the street that is connected with the sewer.

Mr. Kelley: I mean one dwelling house.

Col. Waring: Quite adequate.

Mr. Kelley: Do you recommend fresh air inlets into the sewer at the outside of the house?

Col. Waring: No, not if that system of ventilation is carried on, because every soil pipe being connected with it, some of those pipes will serve as inlets and some as outlets; some will be on the sunny side of the house and some on the shady side; some will be connected with warm rooms and some with cold rooms, and circulation enough will be supplied without any fresh air inlet.

Mr. Kelley: Do you recommend the ventilation of every trap in the house?

Col. Waring: No sir, not at all. I will be frank, however, to say that I am opposed in that view by a great many other people.

Mr. Kelley: By all the plumbers in the country.

Col. Waring: Of course, the plumber—it pays him to ventilate. (Laughter) There are a few cases where it is necessary to introduce air to prevent siphonage in the trap. Where that has to be done there is no system so good—back venting don't compare with it—as the use of what is called "McClellan's trap vent." That is a little cup inverted in mercury, which will respond to the pressure of a half an inch elevation of water, and operates in such way as to prevent siphonage. Then there are two or three other contrivances used to accomplish the same purpose.

Mr. A. W. Thurman: What do you mean by a trap in the main line?

Col. Waring: I mean a trap cutting off the air of the house drain and soil pipe in the house from the air of the sewer. The theory was that house drainage was liable to all manner of defects, and that if any thing disagreeable or dangerous entered the house pipes, it would escape into the house; that therefore, as the source of all danger was in the sewer, you must put in a trap to shut it off. Now I maintain, and I think it is entirely true, that most of the odor you get in your house drains is due to the decomposition of the filth produced in the house itself lodging in the trap and in the drain back of the trap, and that by putting a trap there you prevent its perfect ventilation. I would therefore run an untrapped drain from the sewer to and through the house, and open above it, and have as free a circulation of air as possible and treat it as a part of the public sewer and then be very careful as to the joints and as to the manner of trapping off from it every fixture of the house. I would not admit

the air of that pipe into the house at all, but I would use it as a ventilator and would then isolate every fixture in the house by a trap of its own.

Mr. Kelley: Colonel, do you recommend the ventilation of the trap under the water closet?

Col. Waring: It depends on what kind of a water closet you use.

Mr. Kelley: Where tank-closets are used—flushing tanks?

Col. Waring: What kind of an arrangement below the hopper?

Mr. Kelley: It has a trap underneath the closet.

Col. Waring: A wash-out closet do you mean, or a pan-closet?

Mr. Kelley: No, we do not have any pan-closets; a wash-out closet and sometimes a plunger.

Col. Waring: With a plunger closet you must have good ventilation. You have a combination of stinks there, and it could not be kept in condition without ventilation in the part below. I am speaking now as a sanitary man and not as an æsthetic man. You will get an odor from almost any closet unless you have seat-ventilation. That is unpleasant, but it does not do any harm.

City Solicitor Jones: What distance from the sewage farm do you suppose the offensive odors would extend?

Col. Waring: Well, I can only speak by example, by referring you to different cases. At Croydon, in England, they have a large sewage farm of about four hundred acres, and there is an elevated foot-path that runs diagonally across this farm to a church that is very much frequented on Sunday afternoon. It is a fashionable church to go to, and the fashionable population of Croydon (which is a place of about the size of Columbus), takes his girl under his arm, and goes over that foot-path and back again every Sunday afternoon, the whole field on both sides being sometimes covered with sewage. The only smell that you get there, or anywhere else on the field, so far as I have investigated, has been from the sliming left in a carrier ditch after the flow has been removed and turned to some other place. Then there would be a smell that you could perceive, probably, the distance between us, but hardly farther. It does not amount to an objection. There is no stench there that you could smell across the Scioto river, for instance, with any thing like decent attention to the work. What you will put on to that farm does not smell; it is not fresh sewage that smells. The only thing in it that originally had any smell is the foecal matter, and that loses its smell after submersion in water for a short time. The sewage will flow for an average of three miles or more through the sewers, then it will be torn to pieces and the solids will be still further mixed with the water in passing through the pumps and then be delivered on to the land. The sewage when it comes out will be about as clean as ordinary dish-water, and will be substantially the same thing. It will be at least 98½ per cent. water; not more than one and one half parts in one hundred of foreign matter, and of that not one-tenth part of any thing that was originally offensive. Now, if you run that liquid for a day through a certain ditch, then shut that ditch off and run it somewhere else, the next day there will be a little smell of the decomposition of the slimy stuff—about as much as you would perceive in going through a farmer's barn-yard—but nothing that any body familiar with it would think of calling an objection to the system. It would not compare with the smell that you get here constantly in town under certain circumstances from your street corner basins. I have not smelled them, but if they do not smell pretty loud at times, they are different from any I have ever come in contact with.

Mr. James M. Loren: I think we have a pretty good idea of Colonel

Waring's conclusions with reference to the intercepting sewer as to size and location. But there are two other matters about which we would like to hear an expression of opinion—one is as to the system of sewerage on the West Side; the other as to the system of sewerage for the North End.

There is a country north of Ninth avenue that has no sewerage. There is authority granted by the Legislature to issue \$90,000 in bonds to build sewerage. There is also authority granted by the Legislature to issue \$250,000 in bonds for the purposes of sewerage for the West Side. I think gentlemen present living on the West Side and in the North End ought to take advantage of this occasion, and draw forth from Colonel Waring such recommendations as he may be able to give. As I understand Colonel Waring, he says that he has not sufficient information upon which to recommend a system for the West Side. I think we ought to get a little more definite information upon that point, and then so far as the sewerage north is concerned, I would like to ask a question or two myself. I believe it is suggested that we have two separate sewers—a sewer for the solid matter for that location, and another sewer for the storm water. An ordinance was passed some time ago, and probably the sewer would have been well under way had it not been for some defect in that ordinance connected with the sale of the bonds, which has occasioned delay. We are about to commence the work, and if we can get any definite information as to what we should do in that locality, and specific information as to the size of sewers, now is the time to do so. I would like to ask what size sewer Colonel Waring would recommend for the solid matter, to run through the territory from east to west and connect with the intercepting sewer; and what size sewer for the storm water emptying into the river. There are also gentlemen here who would like to ask questions concerning the West Side.

Col. Waring: I think that as to the matter of principle and probably in detail, the conditions at the West Side and at the North End are the same, so far as the system is concerned. I did not mean to say with regard to the West Side that I could not determine between the two systems of sewerage, but simply between the two methods of disposal; when the sewage is brought to a certain low point, whether it should be carried by a gravity sewer to the irrigation land, or whether it should be pumped across the river and conveyed in to the present intercepting sewer, to be pumped back again, or whether it should be pumped directly, through similar means, to the field. That is simply a question of mathematics, as to which would be the best and most economical. So far as the system to be adopted is concerned and the size of the pipes for the West Side, and for the North End, and for any new district that you may have, it should be regulated on this basis, I think, that there should be no sewer less than six inches in diameter, because you can't have a house drain less than four inches, and you want a sewer that will surely take care of whatever comes through the four-inch house drain. If you have a reasonable fall, and you must have not less than one foot to 300, you can use a diameter of six inches safely for a length of about 1,250 feet.

Mr. Loren: What population?

Col. Waring: I have assumed that the street has a house on every 25 feet of ground on both sides, and that seven persons live in each house. Although you may not need that now, you may have a condition later on corresponding to that. That is the basis on which we regulate the size of sewers always, assuming that every 25-foot lot may some day have a house, and that house may be occupied by an average family of seven

persons, and that they will use 60 gallons of water a day for each person. We start out with that as a basis to calculate from, and take the capacity of the sewer according to its fall, and use the smallest size which would at the hour of greatest flow run not more than half full. Then we increase the size of the sewer to eight, nine, ten, twelve and to fifteen inches, as required.

The West Side seems to me to be pretty flat, and of course there the size of the sewer would have to be increased more rapidly than they would have to be in the upper end of the town where the inclination is considerably more rapid. I believe that in both of these cases they should be treated with what is called the double system; that is, there are two distinct operations, though they may both have to be paid for under the general title of sewerage. One system is to take the storm water that would do harm for any reason and carry it to the river; the other is to take the water that is loaded with all manner of waste material from the houses, and carry that carefully, and as rapidly as possible to the intercepting sewer, which will take it to the sewage farm.

I can not give you any very definite idea as to the sizes and the length to which each size may be used, but I think I can say with confidence that the house drainage system, in either one of these localities, would not—until you come to the intercepting sewer—cost more than about eighty cents a foot, all told. That would be about 40 cents a foot for each side of the street, assuming the city to pay for street crossings. What is your custom in that regard, Mr. Loren?

Mr. Loren: If any body can tell what the custom is they can do better than I can; we have all sorts of customs.

Mr. Kinnear: It is generally paid for by the foot front; the property holders paying for street crossings.

Col. Waring: It would then be from 85 to 90 cents a foot.

Mr. Loren: Would you recommend an intercepting sewer for the West Side?

Col. Waring: Well, Mr. Loren, in one sense you have an intercepting sewer wherever you have a main sewer. You have to have some one sewer if you have lands sloping in one direction into which you can run the local sewers, and it can be called either an intercepting sewer or a main sewer. What is commonly meant by an intercepting sewer is a sewer which intercepts a certain amount of flow and lets the excess go on.

Mr. Loren: What would keep the water from backing up and flowing into the cellars?

Col. Waring: What keeps it now from filling the cellars?

Mr. Loren: Well, we haven't any sewerage now.

Col. Waring: That is simply a question of detail. If you build a town below the water level, you will have to manage in some way to keep your cellars dry.

Mr. Loren: Well, it is a fact that there is a territory on the west side and along the east side, if it is ever built upon, where we could not possibly drain the storm water into the river without occasionally having the storm water coming back the other way and running from the river into the cellar.

Col. Waring: Why is it necessary to have your cellars connected with the sewers?

Mr. Loren: In some places it is necessary; there is about seven feet of water in the cellar. Where would you put that water in the cellar unless you would sewer it into the river?

Col. Waring: Is the whole ground full of water?

Mr. Loren: Yes, sir, every thing is full of water: at least the cellar is full.

Col. Waring: Then I would fill up the cellar with something besides water and give it up.

Mr. Loren: That is what we do not want to do if we can avoid it.

Col. Waring: You can treat the whole thing on what the Dutch call a "polder," and pump it out. You can put in a pumping arrangement there so that when the water comes up from the river it will have sufficient capacity to take away all the water that you have in your ground; but that is an expensive luxury. You can expend your money in a much better way in a great many other directions. You can also build a cofferdam, but that costs a good deal.

Mr. Loren: It is a fact that there are some portions of the north, and I suppose the west sides, and also on the east side, that have no sewerage and where water is found in the cellar.

Col. Waring: Isn't that due entirely to the want of sewerage. The ground generally must lie high enough for drainage.

Mr. Loren: In the north end it does, but not in all cases. I do not know that I got the point I wanted in regard to the sewerage on the north side. I do not want to make an interrogation point of myself, but I would like to have some other member of the audience turn himself into an interrogation point in order that we may take advantage of this occasion to ascertain certain facts which we wish to know. I would like to ask this question: In sewerage the north side, suppose we have a sewer six feet in diameter at the river and continue it east a mile and a half, what size should it be at the east end of the sewer?

Col. Waring: You are speaking now of a storm water sewer?

Mr. Loren: Yes.

Col. Waring: Well, that question can not be answered here and now. If you will give me the area of the water shed from which the flow will come toward that valley and give me an idea as to the manner in which it is to be paved and covered with houses, so that I can determine how the water will accumulate in the central valley of that area, I can then determine how far it is necessary to make that system of sewerage underground, and how far you can rely upon your gutters to take the water.

Mr. Loren: What size of underground sewer would be necessary to deliver the water to the river?

Col. Waring: It would be impossible to form any opinion. That is a question purely of mathematics. You have to have the levels of the place so that you can ascertain the amount of water which will come within the area to be drained by the sewer. You must know the character of the soil and how it is likely to be covered. A dozen considerations enter into the calculation in making such an estimate, and when you have them all you must make as good a guess at it as you can.

Mr. Loren: We have a country up there in the extreme north end that is sparsely populated—not very many houses and yet there are a good many people up there too; but they have no sewerage. Now if we adopt the double system of sewerage to cover the purposes for all time to come, what size, in your judgment, should we make the sewer for the solid matter?

Col. Waring: Have you a good fall there?

Mr. Loren: There is a good fall.

Col. Waring: I should think there was a very fair fall over the whole tract but without more data than at present before me, it is a very difficult matter to give you a reliable estimate. I will say, for example, in order to give you some figures to work on, that in the town of Stanford, Conn., (a town of ten to twelve thousand population) the main sewer that carries every thing is only eighteen inches in diameter and the flow runs about three inches deep in the sewer and it hasn't a very rapid fall. I could give you figures from a great many other places, but it would only give you a general idea. For instance, Memphis, Tenn., when it had a population of forty thousand, had a main sewer twenty inches in diameter, having a fall of only one to six hundred. Whether you have a fall of one to six hundred or one to three hundred, makes an enormous difference in the size sewer you have to use. The only way to get at it is to have the whole district that is to be drained to a certain outlet, leveled and then make careful plans. The cost of doing that would of course be a very small sum as compared with what you might lose by guessing at it and endeavoring to get it "big enough anyhow." I think with regard to all of those districts, you ought first to make careful definite plans as to what is required, and let your work be done according to those plans, avoiding expensive work and too contracted work; avoid getting sewers that will not answer the purpose, and avoid getting sewers that cost you too much money.

Mr. Loren: Until we get an idea of just what is required, it is very difficult to make a plan, and that is the point we wish to ascertain. We are now ready to enter upon that work.

Col. Waring: Perhaps I can get at what you are seeking in another way. You have a certain district that you want to sewer. Now I should have levels taken at every street corner and at every alley corner, over the whole district, in the first place; then I should determine how many people would live or might live on each one of those streets; how much sewage they would produce; whether the amount coming down this street should be carried on for three or four blocks, or whether the lay of the land indicates that it should go over and connect with the next street and go down with that; then calculate what each one of those lines must do, regulating it according to the inclination on which the sewer must be constructed. That will indicate the diameter you must have. But that is not a thing that can be done off-hand. I have no doubt you have engineers in your service who could do the necessary work to secure the required data perfectly well.

Mr. Pierce: With your permission I will ask Col. Waring a question. He has told us that that 24-inch sewer is adequate, and bases his figures upon a population of thirty-three thousand. As I understand it, we are going to have more population up there than that.

Col. Waring: But, sir, the sewer grows larger as you come toward the center of the city.

Mr. Pierce: Yes, but you say that you base it upon a population of that number above the line at which it is increased in size, and we think that the time will come when there will be more people above that line than you have calculated.

Col. Waring: That is something I know nothing about.

Mr. Pierce: I am a comparative stranger in the North End myself and have never been over the ground much, but it has always struck me that that sewer was not large enough.

Col. Waring: That 24-inch sewer is nearly a mile in length, beginning at the dam at Olentangy creek, being carried to that point in order

to get flushing supply. Now to just what point the 24-inch sewer comes, I am not familiar enough with the city to state.

Mr. Cockell: The line runs about four rods, I should think, from the hill on the bottom land.

Col. Waring: What population will be likely to be upon that area in the future, supposing it is all filled up?

Mr. Cockell: That is pretty hard to judge, but I would think from the present growth, that it will be a great deal larger than it is in a very short time. It is growing rapidly, and we feared that the sewer was too small in diameter.

Col. Waring: It seems to me if you have a town of less than a hundred thousand inhabitants, eight miles long, that when you allow thirty-three thousand in the first mile, way out from the center, you are making a pretty good allowance. I don't believe, on general principles, you will have 15,000 people in that mile. That sewer would accommodate certainly one third of the entire population of Columbus to-day. Do you suppose that one-third of the whole present population of Columbus is ever going to be equaled within a mile of the northern boundary?

Mr. Pierce: Mr. Loren is the man to answer that question.

Mr. Loren: I am considered an enthusiast on that end of the town. The only way you can estimate that at all is to say that the territory is a mile long and is three miles wide, and then you want to estimate that there will be as many people within that territory as can possibly get there. [Laughter].

William G. Deshler: Col. Waring has estimated that there will be 28 people to every 100 feet of street on each side, and has started off upon that basis.

Col. Waring: As you go east in that first mile, don't you strike land that will naturally drain this way?

Mr. Loren: How is that, Mr. Kinnear?

Mr. Kinnear: When you go back a mile from Olentangy creek, you strike courses of land which drain to the south and west.

Mr. Palmer: I suppose so far as the foul sewage is concerned, that the intercepting sewer is sufficient, but I think under the present condition of things, that a large amount of rain water will go into the sewer, and taking that into consideration I think the sewer ought to be larger.

Col. Waring: Well, I think that you ought not to allow the rain water to go into the sewer, because when you get it into the sewer you have to pump it out again, and you have to treat it the same as foul water, by the same expensive process. I am looking to the ultimate recommendation that no storm water whatever, shall, in any new work, be allowed to go into the intercepting sewer, and that in time all storm water will be kept out of the intercepting sewer in the old parts of the town.

Mr. Palmer: North High street being paved with asphalt, and with the present sewer drops at the corners of the streets, it would be impossible to prevent storm water from entering the intercepting sewer. Taking things as they are, and not as they ought to be, I think that necessarily a good deal of rain water will go into the sewers.

Col. Waring: Well, I would not intercept that sewer; I would let the flow of that sewer into some other outlet and confine the intercepting sewer to the house drainage.

Mr. Palmer: If you adopt the double system, of course, that would be all right.

Col. Waring: You can not avoid the double system unless you want to be very extravagant, because you have to take care of your sewage by some artificial process, during a very large part of the time. I am speaking now of what I believe will surely be the result of public sentiment, what you yourself will think in five years, and what the city will require—that under certain conditions you have to keep all of your filth out of the river.

Mr. Palmer: While we may come to that in course of time, it takes a good while for cities to move, and we have to take things as they are now. The question is this: we have a sewer two feet in diameter, and I would like to know whether during the next three years it won't be too small?

Col. Waring: If I had charge of your sewerage, I would not allow the intercepting sewer in new parts of the town to intercept storm water at all. I would devote the large sewers to the removal of storm water and convey it to the river and dispose of it in that way, and would have separate sewers to carry the foul wastes into the intercepting sewer.

Mr. Loren: The sewerage could not pass through the present sewers into the river without causing a nuisance in a very short time. The river is not a very large stream at certain seasons of the year. In the summer time there are many places where a lady can step across the stream, with her slippers on.

A Member: Three years ago the Scioto river stopped flowing entirely in this city.

Mr. Loren: We haven't such a magnificent stream of water, when the boats stop running. [Laughter.]

Col. Waring: Then I would build the two sewers now. That is all I maintain; that there is no way out of it but that. And all the storm water you put into this intercepting sewer hereafter is going to be the source of just so much trouble and expense to you. That I am very clear about.

Mr. Loren: Then, as we understand, the only recommendation you would make as to the two-foot sewer, is to change from pipe to brick?

Col. Waring: Yes; that is all I am in a condition to make. I do not say that the dividing line between the twenty-four-inch and the thirty-inch sewer is where it ought to be; I do not say it ought not to be pushed farther south. About that I am not competent to judge. I am only saying that the two foot sewer will supply 33,000 people for their foul sewage, and that it ought not to be build of pipe but of brick.

Mr. A. W. Thurman: Suppose we had a main sewer running out Broad street, with a fall of 1 to 300, under the double system, devoted only to house drainage, what sized sewer should it be?

Col. Waring: Just a single sewer, draining only the houses along the street?

Mr. Thurman: Yes; not taking any branches, but just for the house drainage of the houses on either side of that street?

Col. Waring: How long is it?

Mr. Thurman: Say two miles.

Col. Waring: Have you a uniform grade?

Mr. Thurman: Yes; there is a fall, I suppose, of twenty feet in that distance.

Col. Waring: That is not uniform.

Mr. Thurman: For a considerable distance there is very little fall, but as you get farther west you get that fall easy enough.

Col. Waring: Yes; but you do not want to go too deep.

Mr. Thurman: You would have to go deep enough to tap the intercepting sewer, wherever that is.

Col. Waring: Of course; but you would not necessarily have to go on a straight line. You want your sewer within a reasonable distance of the surface. If you can give that sewer a fall of 1 to 300 or 1 to 250 and put in a 10-inch pipe, you will never see it half full, nor any thing like half full, provided you keep your rain-water out of it.

Mr. Bowen: It seems to be fairly well understood that the intercepting sewer is large enough. Now, I would like to know if, when constructed, it will answer the purposes for which it was intended; that is, prevent the pollution of the water in the river?

Col. Waring: I see no reason why it should not, if it is properly managed: it is capable of intercepting the dry weather flow of all the sewers.

Mr. Bowen: Isn't that upon the assumption that the dry weather flow takes all of the solid sewage that is deposited from vaults, etc.?

Col. Waring: I don't quite understand your question.

Mr. Bowen: Don't we understand that the dry flow discharges all the excreta that is drawn into the sewer from house drainage?

Col. Waring: Yes.

Mr. Bowen: Is that true as a matter of fact?

Col. Waring: Well, it is not to this extent; if you have got an imperfect sewer that does not run clean, a good deal of that solid matter will be deposited, and when there comes a heavy rain it will flush out the sewer and carry that deposit with it. The probability, however, is that the most of it will be washed out at the beginning of the rain, when it will still be running into the intercepting sewer. So far as the regular contribution of foul matter is concerned, there is no doubt that the intercepting sewer will take the whole of it. So far as the accumulated deposits of the sewer is concerned, I think there is no doubt that the intercepting sewer will take all of it that the early part of the rain fall would flush out: then what follows under the heavy flood will go into the river, but it will go with such a largely increased stream as to do no harm.

Mr. Bowen: It occurred to me it would only be a temporary relief. Now, take, for instance, the Fourth street sewer; the main sewer is seven feet in diameter. The house drains are all tapped into it above the spring of the arch. Now, the solid sewage matter, coming in from dwellings and vaults, slides down the pipe until it gets to the end, and just drops over and forms an accumulation on the invert of the sewer, at the very in-let: that remains there during the dry flow, until the storm water comes, and the whole thing is flushed out, and at that time, according to my understanding of the way the intercepting sewer is built, there is no other way for it only, in this general flushing out, to go into the river.

Col. Waring: But, don't you think in the beginning of the rain fall, this stuff will be flushed out and it will get its chance in the intercepting sewer just as well as what is above and below it?

Mr. Bowen: It will depend upon how much or what proportion of the storm water the intercepting sewer will take.

Col. Waring: The intercepting sewer can take a great deal of it; a very large amount. I would say that your intercepting sewer, running two thirds full, would take the dry weather flow of a population of over a half a million people; it would really take the dry weather flow of nearly a million people if it ran full. So you see there is an enormous margin there for storm water.

Mr. Bowen: With the present population, it would take then, you think, nearly the entire storm flow?

Col. Waring: You can not calculate storm flow according to population. Sometimes in a heavy rain it would be tremendous. To put it in another form—if there came up a good sharp shower, all the water that reached the sewer in ten minutes over the whole city, would be discharged into the intercepting sewer, and during that ten minutes most all the accumulations you speak of would be washed out and go down the intercepting sewer.

Mr. Bowen: Don't you think it would be a good idea to construct some system of flushing occasionally?

Col. Waring: Flushing? Yes, undoubtedly; I do most decidedly; there is nothing like it.

Mr. Bowen: So as to prevent an excessive amount of accumulation?

Col. Waring: Yes, there is no doubt about that; but I think it would be much better to build separate sewers for that particular purpose, but that of course would be expensive and have a great many complications connected with it.

Mr. Deshler: With reference to the lower end of the sewer—who is to determine where it shall end? Is it the four kings, the city council, or who?

Mr. Loren: We of course expect to get Col. Waring's opinion in writing upon that subject, and then take such action as we thought would meet the best interests of the city and the necessities of the case demand.

Mr. Deshler: Can the city condemn that land if it is found necessary to do it?

City Solicitor Jones: Not under the present legislation; we would now have the power to condemn it for sewer purpose, but not for "sewage farm purposes."

Mr. Loren: As the contract for the completion of the intercepting sewer does not expire before another legislature meets, we can secure such necessary legislation in that regard as may be required.

Mr. Thurman: Last summer two years ago, where the sewers emptied into the river, down about the Moler dam, the stench that arose from that locality was so horrible as to render that portion of the city almost uninhabitable, and it was said that it was caused on account of the deposit of sewage in the river at that point.

Col. Waring: I was informed, though I do not know it, that the cause was the building of a dam by the city and depositing the sewage in the pool.

Mr. Bowen: I will state that there was a natural pool at that point into which the sewage was discharged, together with that accumulation. There was considerable stench there, but in my observation, and I had a pretty good chance of knowing, three-fourths of that stench came from the canal. It was to obviate the stench in the river that the dam was built.

Col. Waring: I do not think that you could discharge the outflow of that intercepting sewer into the river for a month in hot weather without creating a nuisance. I think, therefore, as soon as you are ready to make that discharge you ought to be ready to take care of your sewage by irrigation process. That is what I mean.

Mr. Thurman: That is what I have reference to in speaking of the stench created a few years ago. I understood you to say that it would not create a nuisance?

Col. Waring: Not at all. I said early in my remarks that an estimate had been made that the sewage might be delivered at the proposed point of outlet for five years without creating a nuisance, but that I felt equally confident that it could not be delivered for five weeks at that point in the summer time without creating a nuisance, and that something should be done with it right away.

City Solicitor Jones: Could that be obviated by a system of flushing?

Col. Waring: No. You can keep things much sweeter in your sewers by a system of flushing, but if you deposit this accumulation in a sluggish stream and leave it to itself it will putrefy, and putrefaction will make the offense. If you had force enough in your river to send it a mile further down it would simply transfer the point of offense a mile below. Where organic matter rots it will stink, and you can't avoid it. The only easy alternative, would be to run it on to land where the solid matter would be purified and rendered innocuous.

Mr. Deshler: Then the danger you suggest of creating a nuisance would apply as well a mile farther down, or five or ten miles farther down or clear down to Portsmouth?

Col. Waring: I suppose so. There is no point to which you can deliver this sewage, but what you will meet with the same difficulty. What you must do is not to deposit it in the river constantly anywhere. Then when you get in a tight place, you can run it into the river for a few days and it will do no harm.

Mr. Griggs: Is this system of disposal of sewage the same system that is used in Pullman?

Col. Waring: Yes, but I should do the work a good deal more carefully than it is done there. That is on a wild stretch of prairie land, and is not so nice a piece of work as you ought to have. Your land is a great deal better adapted to sewage purposes than is their land, which is an almost dead level prairie. Their's is not a very good piece of land for sewage, but then there is very little sewage at Pullman as compared with the amount you have.

Mr. Deshler: That is distributed by the pumping process?

Col. Waring: Yes, sir.

Mr. Deshler: What conclusion was arrived at with reference to the West Side—raise the land or dig up the cellars, or what?

Mr. Loren: Col. Waring, as I understand, recommends that the storm water sewers go into the river, is there is sufficient fall, so that the water from the river will not flow back into the cellars; otherwise the storm water will necessarily have to be pumped with the rest of the sewage.

Mr. Thurman: I should think there would be very little danger of water over on the West Side, as the whole ground down a short distance, is gravel.

Col. Waring: Will not that gravel fill up with water also when the river rises?

Mr. Deshler: That is just what is the matter.

Col. Waring: And if you undertake to pump that you will pump "all outdoors." It is a good place not to have a cellar.

Mr. Borger: If you dig down over three feet, you get water at certain seasons of the year; but in the summer time it is very dry.

Col. Waring: Then you dig down a certain depth, and then get the necessary depth for your cellar by building above ground?

Mr. Borger: Yes, sir.

Col. Waring: I should think that was the only safe way.

Mr. Cockell: We have a system of sewerage in the North End already contracted for, to carry the sewage 2,800 feet to the intercepting sewer. I believe it has been arranged to put in a sewer 15 inches in diameter. According to your system I suppose we ought to put in two sewers instead of one 15 inches in diameter, to carry the sewage for the 2,800 feet to the intercepting sewer?

Col. Waring: I should think so, yes.

Mr. Cockell: If any change is to be made, I should think it ought to be made now?

Col. Waring: I think that would be wise.

A vote of thanks was then tendered Col. Waring, and the chairman declared the meeting adjourned.

